

A REVIEW OF THE TAXONOMIC AND DISTRIBUTIONAL
RELATIONSHIPS OF *PLEOCOMA HOPPINGI* FALL
AND *PLEOCOMA RUBIGINOSA* HOVORE
(COLEOPTERA:SCARABAEIDAE)

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ABSTRACT

Distributional data for the *Pleocoma hoppingi*–*Pleocoma rubiginosa* species complex are recorded, and clinal character tendencies are discussed. Structural and meristic characters utilized in species differentiation are analyzed, and the antennomeres for the known population samples of both species are characterized. *P. r. transsierrae* is described as new, and a description is presented for the female of *P. r. rubiginosa*. Comparisons are given between females of *P. hoppingi* and *P. rubiginosa*, and the problems inherent in *Pleocoma* female differentiation are discussed.

Pleocoma hoppingi Fall and *Pleocoma rubiginosa* Hovore together comprise a species complex structurally distinct from the remainder of the genus. Both species have the integument and pubescence uniformly pale reddish-brown, the pronotal surface densely, coarsely punctate-pubescent, and the ocular canthi subquadrate in dorsal outline; both are presently known only from moderate to high elevations in the Sierra Nevada of California (Fig. 1). *Pleocoma hoppingi* appears to be more or less continuously distributed on the western slope from Calaveras County south to central Tulare County. *Pleocoma rubiginosa* has been collected on the western slope of the Sierra Nevada in southern Tulare County and northern Kern County, then eastward at several localities on the Kern Plateau and along the eastern slope as far north as southern Mono County.

Hovore (1977) discussed some aspects of phenotype variation in several species of *Pleocoma* and suggested that many populations previously regarded as full species are actually variants from within widely distributed polytypic species. The present study was undertaken to better define the relative status of *P. hoppingi* and *P. rubiginosa* and to assess the taxonomic value of the presently used differentiating characters. Both species were very poorly represented in collections, most material being old and often damaged to such an extent as to be taxonomically useless. However, available locality data indicated that both species had been collected at relatively accessible locations. It soon became evident that difficulties in collecting insects at high elevations during inclement weather, rather than rarity of the species in nature, had accounted for the scarcity of museum specimens. Improved roads and greater availability of electricity for lights facilitated the search, and soon, numerous "populations" had been sampled.

Although each sample exhibited a slightly different set of quantitative character states, a constant series of structural differences was found by which samples could be objectively assigned to either "typical" *P. hoppingi* or "typical" *P. rubiginosa*. Moreover, samples of *P. hoppingi* exhibited a relatively uniform south-to-north clinal reduction in the antennal formula, whereas *P. rubiginosa* appeared to be divided into two widely distributed but allopatric phenotypic groupings. The nominotypical phenotype of *P. rubiginosa* occurs over most of the known distributional range for the species, but a group of small, isolated populations from Mono and Inyo Counties differ sufficiently to be recognized as a distinct subspecies, described herein.



Fig. 1. Distribution map of *Pleocoma hoppingi* (shaded squares), *Pleocoma r. rubiginosa* (open circles), and *P. r. transsierrae* (shaded circles).

The close superficial resemblance of *P. hoppingi* to *P. rubiginosa*, along with similarities of habitat preference and season of adult activity, indicate a common progenitor. However, males of the two taxa are readily distinguished by a number of apparently qualitative anatomical features (Table 1), indicating complete speciation. These characters are remarkably constant in the material examined, with little significant interpopulational variation. The sculpturation of the ocular canthi and relative development of the head structures, though differing in degree of variability from sample to sample, generally substantiate species differentiation. In *P. hoppingi* the ocular canthi usually project at a right angle to the midline of the head, with the anterior margin strongly sinuate and the apex slightly emarginated (Fig. 4); the ocular canthi of *P. rubiginosa* usually project slightly forward from a right angle, with the anterior margin only very feebly sinuate and the apex truncate or rounded (Fig. 5). In both species the ocular canthi are subquadrate, a condition not found thus far in the remainder of the genus. Also, male *P. hoppingi* have the head structures reduced in size (Fig. 6), whereas nominotypical *P. rubiginosa* have the head structures very pronounced (Fig. 7).

DISCUSSION OF VARIATION IN MALES OF *P. hoppingi*.

Population samples examined of *P. hoppingi* displayed a south-to-north clinal reduction in the number of long lamellae comprising the antennal club, with coincidental reductions in the lengths of the intermediate lamellae. Briefly, male antennal formulae for the known population samples are characterized as follows:

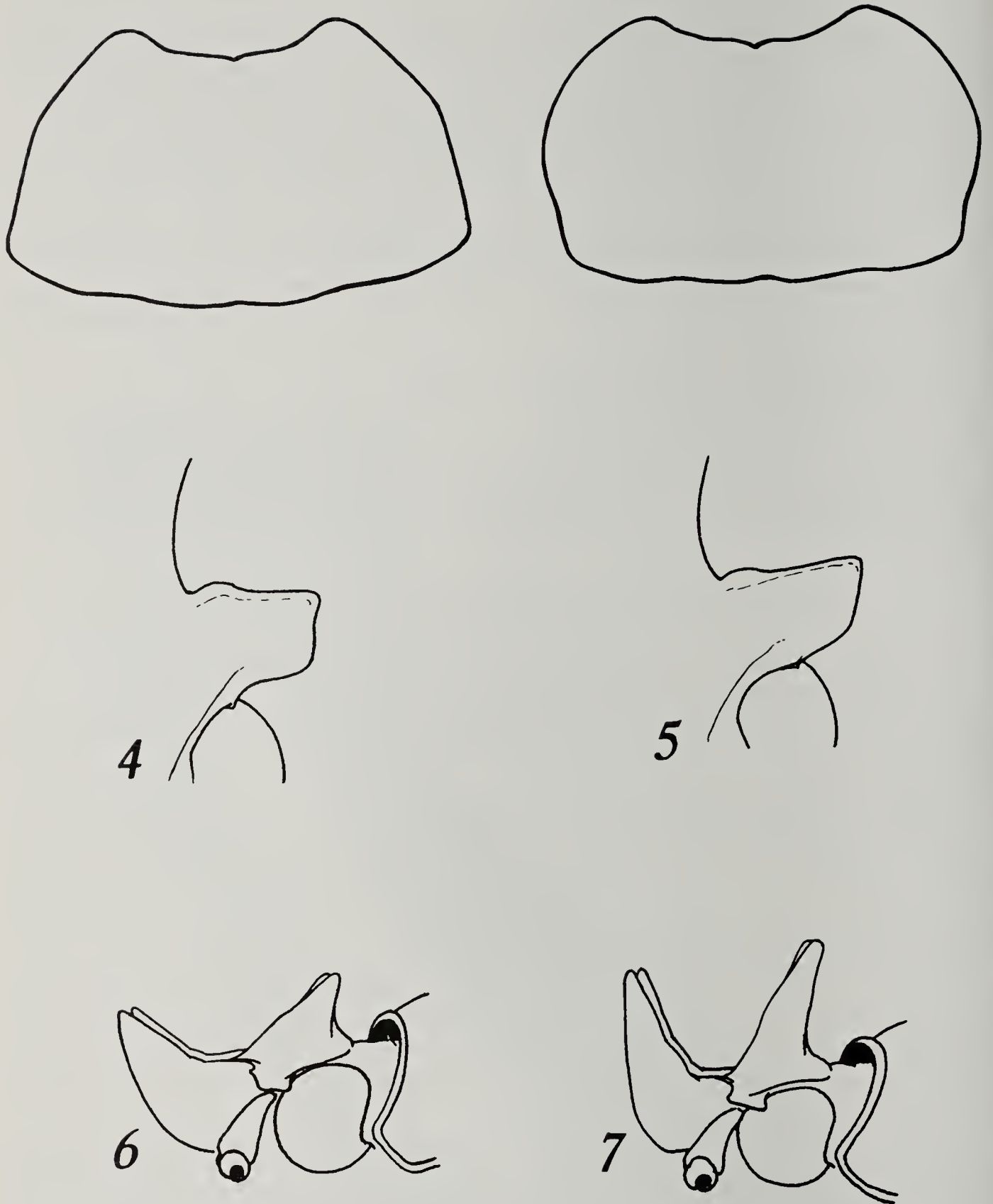
Tulare County, "South fork of the Kaweah River" (Type locality): segment 3 strongly flattened anteroventrally, segment 4 with lamella from $1/3$ to $1/2$ as long as that of segment 5, lamella of segment 5 only slightly shorter than that of segment 6, lamellae of segments 7 to 11 more or less subequal (based upon holotype and 6 cotypes).

Tulare County, "Mineral King road, above Hammond": segment 3 strongly flattened anteroventrally, segment 4 with lamella nearly $2/3$ as long as that of segment 5, lamella of segment 5 only slightly shorter than that of segment 6, lamellae of segments 7 to 11 more or less subequal (1 specimen).

Tulare County, 1 mi WSW Eshom: segment 3 flattened anteroventrally, segment 4 strongly transverse with moderate projection, lamella of segment 5 about $2/3$ as long as that of segment 6, lamellae of segments 7 to 11 more or less subequal (1 specimen). One of two specimens examined from "Colony Road, Tulare County" has the antennae similar to those of the Eshom specimen.

Fresno County, Millwood: segment 3 angulated anteriorly, only slightly flattened, segment 4 transverse with a short projection, lamella of segment 5 about $2/3$ as long as that of segment 6, lamellae of segments 7 to 11 more or less subequal (1 specimen). One of two specimens examined from "Colony Road, Tulare County" has the antennae similar to those of the Millwood specimen.

Fresno County, Shaver Lake: segment 3 angulated and flattened anteriorly, segment 4 with lamella slightly more than $1/2$ as long as that of



Figs. 2-3. Dorsal view, pronotal outline of male *Pleocoma hoppingi* (2) and *Pleocoma rubiginosa* (3). Details of punctation and pubescence omitted.

Figs. 4-5. Dorsal outline of right ocular canthus of male *Pleocoma hoppingi* (4) and *Pleocoma rubiginosa* (5). Details of punctation and pubescence omitted.

Figs. 6-7. Left lateral outline of dorsal head structures of male *Pleocoma hoppingi* (6) and *Pleocoma rubiginosa* (7). Details of punctation, pubescence, mouthparts, and antennae omitted.

segment 5, lamella of segment 5 more than $7/8$ as long as that of segment 6, segment 6 slightly shorter than segment 7, lamellae of segments 7 to 11 more or less subequal (1 specimen).

Madera County, 2.5 mi S Bass Lake: segment 3 broadly flattened and angulated anteriorly, segment 4 with short lamella, slightly less than $1/2$ as long as that of segment 5, lamella of segment 5 only slightly shorter than that of segment 6, lamellae of segments 7 to 11 more or less subequal (1 specimen).

Mariposa County, Miami Ranger Station, near Fish Camp; Cascades area and Foresta, Yosemite National Park: segment 3 usually flattened anteriorly, segment 4 strongly transverse, acutely angulated or with short projection, segment 5 with lamella from about $1/2$ to $3/4$ as long as that of segment 6, lamella of segment 6 from $7/8$ as long to subequal in length with lamella of segment 7, segment 7 slightly shorter than segment 8, lamellae of segments 8 to 11 more or less subequal (136 specimens).

Tuolumne County, Twain Harte; Confidence; Long Barn; Cold Springs; Dodge Ridge; Strawberry: segment 3 slightly flattened and angulated anteriorly, segment 4 moderately transverse, strongly angulated anteriorly, segment 5 strongly transverse with a short projection, segment 6 with lamella from $1/2$ to $2/3$ as long as that of segment 7, lamella of segment 7 about $7/8$ as long as that of segment 8, segment 8 shorter than segment 9, lamellae of segments 9 to 11 more or less subequal (22 specimens).

Calaveras County, Hathaway Pines; Avery; Arnold and vicinity: segment 3 usually feebly flattened, angulated anteriorly, segment 4 moderately transverse, segment 5 strongly transverse, usually with a short projection, segment 6 with short lamella, from $1/2$ to $2/3$ as long as that of segment 7, lamella of segment 7 about $1/2$ as long as that of segment 8, lamella of segment 8 distinctly shorter than that of segment 9, lamellae of segments 9 to 11 more or less subequal (41 specimens).

TABLE 1. Character state differences between males of *Pleocoma hoppingi* Fall and *Pleocoma rubiginosa* Hovore.

<i>Pleocoma hoppingi</i>	<i>Pleocoma rubiginosa</i>
Antennal segment 3 angulated anteriorly or with flattened anteroven-tral process.	Antennal segment 3 simple, elongate, subcylindrical.
Pronotal disc without median longi-tudinal impunctate line.	Pronotal disc usually with distinct median longitudinal impunctate line.
Elytral humeri with striae distinctly impressed and punctate, many punctures with long, erect hairs.	Elytral striae at humeri only feebly impressed, lightly punctate, glabrous or at most with few erect hairs.
Geminate striae on elytral disc dis-tinctly impressed, regularly punctate.	Elytral striae feebly impressed, finely, shallowly, irregularly punctate.
Pronotum small (relative to overall body size), widest at posterior angles, posterior angles narrowly, obtusely rounded; sides distinctly tapering an-teriorly from posterior to anterior angles (Fig. 2).	Pronotum robust, widest at or slightly behind middle, rarely at posterior angles, posterior angles broadly, evenly rounded; sides usually broadly convex between posterior and anterior angles (Fig. 3).
Body form usually narrowly oblong-oval, elytral sides subparallel.	Body form more broadly oval, ely-tral sides broadly rounded.

When a series of specimens was available from a single locality or contiguous localities, the antennal formulae displayed considerable minor variation, expressing transitional tendencies between geographically proximate samples along the south-north cline. The number of long lamellae seems relatively stable in Tulare and Fresno Counties, most variation being expressed in the development of the fourth segment, which in some individuals is long enough to create an octo-lamellate club. Characters such as the dorsal outline of the ocular canthi, relative pronotal and elytral proportions, or placement and size of pronotal impunctate areas also proved to be extremely variable both within and between samples. As material from areas geographically intermediate to the presently known localities becomes available for study, it is probable that the character transition between samples will continue to be consistent with the patterns reflected in the above characterizations.

DISCUSSION OF VARIATION IN MALES OF *P. rubiginosa*.

Within the material examined of *P. rubiginosa* there was a tendency toward a west-to-east reduction of the male antennal formulae. However, the presently known geographical distribution of this species is extremely fragmentary, and so it remains to be seen whether a true clinal pattern exists. I have records for this complex from Kernville, Walker Pass and the Piute Mountains, all in Kern County, but I have not yet been able to obtain or examine specimens from those localities.

Males of *P. rubiginosa* from the presently known localities are briefly characterized as follows:

Tulare County, 1 mi W Posey; 2 mi N Posey: form robust, length 22-29 mm; head structures very pronounced (Fig. 7), even in smaller specimens; antennae with segment 3 simple, elongate, subcylindrical, segment 4 short, transverse, slightly angulated anteriorly, segment 5 strongly transverse with a short to moderate projection, segment 6 with lamella from about 1/2 to nearly 3/4 as long as that of segment 7, lamella of segment 7 more than 4/5 as long as that of segment 8, lamella of segment 8 only slightly shorter than that of segment 9, lamellae of segments 9 to 11 more or less subequal (based upon holotype, 15 paratypes, and 15 topotypical specimens).

Tulare County, Lamont Meadows, 5,600 feet elevation: form robust, length 20.5-25 mm; head structures very pronounced; antennae with segment 3 simple or very slightly, evenly swollen apically, segment 4 short, simple or slightly angulated anteriorly, segment 5 acutely angulated anteriorly or transverse with short projection, segment 6 with short lamella, from about 1/3 to 1/2 as long as that of segment 7, lamella of segment 7 more than 4/5 as long as that of segment 8, segment 8 slightly shorter than segment 9 (12 specimens).

Tulare County: 1 mi S and 4 mi S Kennedy Meadows, 6,400-7,000 feet elevation: form robust, length 22-27 mm; head structures very pronounced; antennae with segment 3 simple, elongate, subcylindrical, segment 4 short, simple or very slightly angulated anteriorly, remainder of antennal formula as in Lamont Meadows sample (19 specimens).

Specimens at hand from Mono and Inyo Counties have the antennal formulae even further reduced, with corresponding reductions in the head structures and in overall size. This material, collected from isolated ridges and canyons high above the Owens Valley, is apparently geographically allopatric from other *P. rubiginosa* populations, and it is my opinion that recognition as a separate subspecies is warranted.

Pleocoma rubiginosa transsierrae Hovore, **new subspecies**

Male. Form moderately robust, broadly oblong-oval, convex, dorsum feebly flattened; integument reddish-brown, pubescence light reddish. *Head* with dorsal surface coarsely, irregularly rugoso-punctate, except for vague impunctate areas at posterior base of vertical horn and in transverse line between ocular canthi, punctate areas densely clothed with erect hairs; clypeal process small, constricted at base, only slightly reflexed apically, apex obtusely notched, apical angles acutely rounded; vertical horn stout, only moderately elongated, sides tapering from base to apical 1/3, then subparallel to apex, apex with acute median notch, apical angles acutely rounded, basal 2/3 coarsely punctate-pubescent, punctures elliptical; ocular canthi subquadrate (this character is subject to considerable distortion through abrasion), projecting slightly forward from a right angle with the midline of the body, anterior edge feebly sinuate; oblique supraorbital carina indistinct; palpi and antennae light reddish-brown; antennal scape stout, subconical, clothed with long stiff hairs, segment 2 moniliform, segment 3 elongate, slightly reflexed, slightly angulated anteriorly, segment 4 simple or feebly angulated anteriorly, segment 5 transverse, acutely angulated anteriorly or with short projection, segment 6 strongly transverse with moderate projection or short lamella, from about 1/3 to 1/2 as long as that of segment 7, lamella of segment 7 from slightly less than 1/2 to 2/3 as long as that of segment 8, lamella of segment 8 distinctly shorter than that of segment 9, lamellae of segments 9 to 11 more or less subequal in length. *Pronotum* usually less than twice as wide as long, usually widest at middle, sides broadly rounded, posterior angles broadly, obtusely rounded, lateral discal impressions feeble, maculate with piceous; disc moderately convex, anterior median surface broadly flattened, surface shining, coarsely, densely punctate except for narrow, median longitudinal impunctate line extending to anterior and posterior margins, entire surface densely clothed with long suberect hairs in unabraded specimens. *Scutellum* broadly rounded at apex, often impressed medially, surface irregularly, moderately coarsely punctate, clothed with long subrecumbent hairs. *Elytra* rich reddish-brown, transparent, shining, surface finely, shallowly punctate, glabrous, sutural striae moderately impressed, shallowly, irregularly punctate, geminate striae at margins of costae feeble, indicated only by single irregular row of fine, shallow punctures, costae impunctate; hairs of marginal fringe relatively short, straight. Length: 16.5-25 mm.

Holotype: Male; California, Inyo County, Coyote Creek, 7,900-9,000 feet, 5 February 1972, Derham Giuliani, collector (Deposited in the collection of the California Academy of Sciences, Entomology). *Paratypes* (65): California, Inyo County: 11 males, same data as holotype; 22 males, Big Pine Creek, 7,400-7,700 feet, various dates in November, December, January and February, 1971 to 1975, Derham Giuliani collector; 5 males, "near Scotty's Spring", 8,000 feet, 11 Feb 1972, D. Giuliani; 2 males, Scotty's Spring, 5,700 feet, 11 Feb 1972, D. Giuliani; 8 males, east slope Wonoga Peak, 8 mi S, 2 mi W Lone Pine, 6,400-7,200 feet, 17 Feb 1972, D. Giuliani; 1 male, Pine Creek, Round Valley, 6,800 feet, 9 Jan 1971, D. Giuliani; 1 male, Sawmill Creek, 6,300 feet, 22 Jan 1971, D. Giuliani; 1 male, 1 mi E Sacatar Pass, 6,800 feet, 23 Feb 1972, D. Giuliani; 2 males, Fuller Creek, 6,500 feet, 14 Jan 1975, D. Giuliani; Mono County: 1 male, Witcher Creek, 7,100 feet, 22 Dec 1972, D. Giuliani; 7 males, Witcher Meadow, 7,600 feet, 22 Dec 1972 (2), 15 Jan 1975 (5), D. Giuliani; 4 males, Sand Canyon, 2 mi S Tom's Place, 7,200-8,100 feet, 11 Mar 1972, D. Giuliani. Paratypes are on deposit in the author's collection; California Academy of Sciences; California Insect Survey Collection, University of California, Berkeley; California State Department of Agriculture; U. S. National Museum; Museum of Comparative Zoology, Harvard College; H. F. Howden collection; D. G. Marqua collection; P. H. Sullivan collection; R. L. Westcott collection; R. L. Penrose collection; D. C. Carlson collection.

Males of *P. rubiginosa transsierrae* differ from those of the nominotypical form primarily by the reduced antennal formula and the consistently reduced size of the head structures. These structural reductions do not appear to be allometric, as larger males of *transsierrae* (24-25 mm.) have much smaller structures than do the smallest specimens from the nominotypical population and Kern Plateau populations (22 mm.). It has not been possible to determine whether the smaller average size of *transsierrae* is a constant differentiating character or merely a generic response to the more severe environmental conditions encountered at very high elevations on the eastern slope of the Sierra Nevada.

The female of this subspecies is as yet unknown in its entirety; however, there is at hand one complete head plus several antennae, collected in Inyo County, Big Pine Creek, 4 Feb 1972, ex. Coyote scats, D. Giuliani. From these fragments it is possible to characterize the salient taxonomic features of the female head as follows: dorsal surface coarsely, irregularly punctate-pubescent, glabrous areas extending from posterior base of vertical horn laterally onto ocular canthi; clypeus reflexed apically, apical angles broadly rounded to median notch, median notch deep, broadly rounded, creating bilobed clypeal outline; eyes barely visible from above, surface slightly flattened; vertical horn reduced to pair of rounded tubercles, posterior basal impressions shallow, impunctate; ocular canthi very stout, subquadrate, anterior edge feebly sinuate, lateral edges slightly emarginated; supraorbital carina feeble, extending onto posterior base of ocular canthi; palpi and antennae light reddish-brown; antennal scape subconical, segment 2 moniliform, segment 3 simple, elongate, subcylindrical, segment 4 moniliform, slightly compressed anteriorly, segment 5 feebly transverse, angulated anteriorly, segment 6 strongly transverse with acute projection, segment 7 with a short lamella, from about 1/2 to 2/3 as long as that of segment 8, lamella of segment 8 slender, more than 4/5 as long as that of segment 9, segments 9 to 11 noticeably thickened, particularly along dorsal edge, more or less subequal in length.

Pleocoma rubiginosa rubiginosa Hovore

The female of *P. rubiginosa rubiginosa* was not known to me at the time of the original description (Hovore 1972), and it seems provident to present it at this time.

Female. Form very robust, broadly ovate, dorsum evenly convex or very slightly flattened; integument light reddish-brown, pubescence pale reddish. *Head* generally similar in all essential respects to that of the subspecies *transsierrae* (given above), except ocular canthi more produced laterally, only feebly quadrate or subtriangular in dorsal outline; antennae not differing measurably from those of *transsierrae*. *Pronotum* strongly, evenly convex, less than twice as wide as long, barely widest at middle, posterior angles broadly, obtusely rounded; discal surface shining, evenly, coarsely punctate except on narrow median longitudinal line, entire surface thinly clothed with short erect hairs in unabraded specimens. *Scutellum* broadly rounded at apex, surface lightly, coarsely punctate, thinly clothed with suberect hairs. *Elytra* rich reddish-brown, transparent, surface shining, finely, shallowly, irregularly punctate, geminate striae at margins of costae feebly impressed, finely, shallowly punctate, costae not or feebly elevated. Length: 22-27 mm. (Above description based upon a series of 5 females collected 1 mi S and 4 mi S Kennedy Meadows, Tulare County)

DISCUSSION OF FEMALE CHARACTERISTICS

The head structures of the females, due primarily to their already much-reduced condition, do not measurably reflect the populational differences exhibited by the males. I cannot find, in the small amount of material available for analysis, any reliable head structure or antennal differences between females of *P. r. transsierrae* and *r. rubiginosa* from near Kennedy Meadows on the Kern Plateau. Males from the Kern Plateau samples have

slightly lower antennal formulae than do topotypical males, and it is possible that females from the latter population would be distinguishable from *transsierrae* on the basis of antennal characters. However, in other closely-related *Pleocoma* populations, where series of females have been available for comparison, most structural and meristic characters by which taxa might be differentiated are subject to considerable variation. Character variability, combined with the fact that all known *Pleocoma* females have pronounced anatomical simplification and structural reduction, often makes quantitative differentiation impractical.

Females of both *P. hoppingi* and *P. rubiginosa sensu lato* are very rare in collections, so comparisons made herein should be regarded as somewhat tentative. In the 3 females examined of *P. hoppingi* (allotype and 2 specimens from Calaveras County), the pronotum is widest at the posterior angles, with the sides gradually tapering to the anterior angles; the ocular canthi are distinctly subquadrate; the geminate striae at the elytral humeri are distinctly impressed and punctate, with numerous long, erect hairs arising from the larger punctures; the clypeal process is not so broadly expanded nor so strongly reflexed as in *rubiginosa*. These differences are essentially diminutives of those cited above for the males, and in series may well prove to be valid characters for distinguishing females of the two species.

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